TCS 209

DRAFT

Tactical Control System (TCS)
to
Joint Surveillance Target Attack Radar System (JSTARS)
Advanced Imagery Common Ground Station (AI CGS)
Interface Design Description

Prepared for:
Program Executive Officer, Cruise Missiles Project
and Unmanned Air Vehicles Joint Project

Prepared by:
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(DRAFT)

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CHANGE RECORD

THIS SHEET IS A RECORD OF EACH ISSUE OF THIS DOCUMENT. WHEN THE REVISED DOCUMENT IS ISSUED, THE PREVIOUS ISSUE IS AUTOMATICALLY SUPERCEDED.

REV	DATE	PAGES CHANGED	*S	*A	REASON FOR CHANGE
1.1 (Draft)	12/4/97				Changed in response to STR CI0015 which recommends traceability to the SSDD. Changed in response to STR CI00XX which recommends complete update of IDD to incorporate agreements between TCS and JSTARS AI CGS programs regarding system interface capabilities, testing with TCS Software Build 1.2, and "sell-off" of Ai CGS in March 1998.
TACTICAL CONTROL SYSTEM (TCS) TO JSTARS ADVANCED IMAGERY (AI) COMMON GROUND STATION (CGS) INTERFACE DESIGN DESCRIPTION					TCS 209

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1. Scope.

1.1 Identification.

This Tactical Control System (TCS) Interface Design Description (IDD) Revision 1.1 identifies, specifies, and establishes the detailed interface requirements between the TCS and the Joint Surveillance Target Attack Radar System (JSTARS) Advanced Imagery Common Ground Station (AI CGS) Version 1.0 C^4I System as set forth by both the TCS System/Subsystem Specification (SSS) Version 1.0 and the TCS System/Subsystem Design Description (SSDD) Version 1.0. This IDD is written to comply with the TCS Operational Requirements Document (ORD) requirement number ORD069. This IDD specifies requirements levied on the TCS, and does not impose any requirements on the AI CGS C^4I System addressed in this document. This IDD further specifies the methods to be used to ensure that each system interface requirement has been met. This IDD is published in accordance with Data Item Description (DID) DI-IPSC-81436, dated 941205, and modified to incorporate the qualification provisions section that is traditionally found in the Interface Requirements Specification (IRS). This IDD will be revised at the conclusion of the Program Definition and Risk Reduction period of the TCS program and will be re-issued in final form to be used during the follow-on TCS Engineering and Manufacturing Development period.

1.2 System Overview.

The purpose of the TCS is to provide the military services with a single command, control, data receipt, data processing, data export and dissemination capability that is interoperable with the family of all present and future tactical unmanned aerial vehicles and designated Command, Control, Communication, Computers, and Intelligence (C^4I) systems. These UAVs shall include the Tactical Unmanned Aerial Vehicle (TUAV) and the Medium Altitude Endurance (MAE) UAV (henceforth referred to as Outrider and Predator respectively), with their associated payloads. Designated C^4I and other systems that TCS will be interoperable with are detailed in paragraph 1.2.2.4 below. TCS will also be capable of receiving and processing information from High Altitude Endurance (HAE) UAVs and their associated payloads, as well as being capable of providing interoperability with future development tactical UAVs and payloads.

1.2.1 TCS Program, Phases, and UAV Interaction.

The Unmanned Aerial Vehicle Joint Project Office (UAV JPO) has undertaken development of a TCS for UAVs. Design and development of the TCS will be conducted in two phases. Phase 1 is defined as the Program Definition and Risk Reduction phase, and Phase 2 is defined as the Engineering and Manufacturing Development phase in accordance with Department of Defense Instruction (DoDI) - 5000.2R. During Phase 2, TCS Low Rate Initial Production (LRIP) will commence. Phase 1 will be a 24 month period and will demonstrate Level 1 through Level 5 interaction (as defined below) in an Incremental and Evolutionary strategy as described in accordance with MIL-STD-498. The five discrete levels of multiple UAV interaction to be provided by the TCS are:

Level 1: receipt and transmission of secondary imagery and/or data

Level 2: direct receipt of imagery and/or data

Level 3: control of the UAV payload in addition to direct receipt of imagery/data

Level 4: control of the UAV, less launch and recovery, plus all the functions of level 3

Level 5: capability to have full function and control of the UAV from takeoff to landing

1.2.2 Tactical Control System Overview.

The TCS is the software, software-related hardware and the extra ground support hardware necessary for the control of the TUAV, the MAE UAV, and future tactical UAVs. The TCS will also provide connectivity to specific C^4I systems. TCS will have the objective capability of receiving HAE UAV payload information. Although developed as a total package, the TCS will be scaleable to meet the users' requirements for deployment. TCS will provide a common Human-Computer Interface (HCI) for tactical airborne platforms to simplify user operations training, and to facilitate seamless integration into the Services' Joint C^4I infrastructure across all levels of interaction.

1.2.2.1 Software.

The major focus of the TCS program is software. The software will provide the UAV operator the necessary tools for computer related communications, mission tasking, mission planning, mission execution, data receipt, data processing, limited data exploitation, and data dissemination. The software will provide a high resolution computer generated graphics user interface that enables a UAV operator trained on one system to control different types of UAVs or UAV payloads with a minimum of additional training. The TCS will operate in an open architecture and be capable of being hosted on computers that are typically supported by the using Service. Software developed will be Defense Information Infrastructure(DII)/Common Operating Environment(COE) compliant, non-proprietary, and the architectural standard for all future tactical UAVs. To the extent possible, the TCS will use standard Department of Defense (DoD) software components to achieve commonality. TCS will provide software portability, scaleable functionality, and support for operational configurations tailored to the users' needs.

1.2.2.2 Hardware.

To the extent possible, TCS will use standard DoD components in order to achieve commonality. TCS will use the computing hardware specified by the service specific procurement contracts. The individual armed services will identify TCS computing hardware, the desired level of TCS functionality, the battlefield C^4I connectivity, and the particular type of air vehicle and payloads to be operated depending upon the deployment concept and area of operations. TCS hardware must be capable of being scaled or modularized to meet varying Service needs. TCS hardware will permit long range communications from one TCS to another, data storage expansion, access to other computers to share in processing capability, and multiple external peripherals.

1.2.2.3 System Compliance.

The TCS will be developed in compliance with the following military and commercial computing systems architecture, communications processing, and imagery architecture standards:

a. Department of Defense Joint Technical Architecture (JTA), including, but not limited to:

Variable Message Format (VMF) and Joint Message Format (JMF)

National Imagery Transmission Format (NITF)

b. Defense Information Infrastructure/Common Operating Environment

c. Computer Open Systems Interface Processor (COSIP)

d. Common Imagery Ground/Surface System (CIGSS) segment of the Distributed Common Ground Station (DCGS).

1.2.2.4 Integration with Joint C^4I Systems.

TCS will be capable of entering DII/COE compliant networks, and TCS integration with C^4I systems will be accomplished through development of interfaces that permit information exchange between the TCS and specified C^4I systems. Network interoperability will include but not be limited to:

Advanced Field Artillery Tactical Data System (AFATDS)

Advanced Tomahawk Weapons Control System (ATWCS)

Air Force Mission Support System (AFMSS)

All Source Analysis System (ASAS)

Army Mission Planning System (AMPS)

Automated Target Handoff System (ATHS)

Closed Circuit Televsion (CCTV)

Common Operational Modeling, Planning, and Simulation Strategy (COMPASS)

Contingency Airborne Reconnaissance System (CARS)

Enhanced Tactical Radar Correlator (ETRAC)

Guardrail Common Sensor/Aerial Common Sensor (ACS) Integrated Processing Facility (IPF)

Intelligence Analysis System (IAS)

Joint Deployable Intelligence Support System (JDISS)

Joint Maritime Command Information System (JMCIS)

Joint Service Imagery Processing System - Air Force (JSIPS)

Joint Service Imagery Processing System - Navy (JSIPS-N)

Joint Surveillance Target Attack Radar System (JSTARS) Ground Station

Module/Common Ground Station (GSM/CGS)

Modernized Imagery Exploitation System (MIES)

Tactical Aircraft Mission Planning System (TAMPS)

Tactical Exploitation Group (TEG)

Tactical Exploitation System (TES)

Theater Battle Management Core System (TBMCS)

TROJAN Special Purpose Integrated Remote Intelligence Terminal (SPIRIT) II

The TCS will export and disseminate UAV imagery products, tactical communication messages, as well as mission plans and target coordinates. TCS will also receive, process, and display tasking orders and operational information from service specific mission planning systems.

1.2.3 JSTARS AI CGS System Overview.

The JSTARS CGS provides Commanders at all levels, Brigade through Corps, with reconnaissance; surveillance; situational development; battlefield management; force protection; target development and targeting for deep attack by aviation or field artillery units; sensor cross cueing; Intelligence Preparation of the Battlefield (IPB); battle damage assessment; theater missile defense and battlefield visualization functions.

Specifically, the CGS receives, processes, displays and disseminates Moving Target Indicator (MTI), Fixed Target Indicator (FTI), and Synthetic Aperture Radar (SAR) data from the JSTARS aircraft (designated as an E-8C). This data is downlinked from the aircraft to a CGS via a dedicated special purpose datalink. This datalink is called the Sensor Control Data Link (SCDL). The ground stations provide the hardware, software, and communications facilities to allow analysts to interpret the JSTARS data and to generate reports.

The CGS provides interfaces to other service systems that will be collocated during Joint Operations. Examples of these are: ASAS, AFATDS, TROJAN SPIRIT, Hunter UAV, Airborne Reconnaissance Low (ARL), and Apache Longbow.

The CGS provides the capability to view, track, and predict the location of radar return data. The analyst is provided the ability to replay missions to filter data from various sources and overlay IPB data. The CGS also provides the capability to access, store, and process other types of sensor data. UAV imagery can be tracked and stored within the CGS, providing the analysts with an ability to visually identify an MTI track. The CGS accepts data from the Intelligence Broadcast System (IBS) and overlays that data on the displays. A Pre-Planned Product Improvement (P3I) Non-Recurring Engineering (NRE) is being performed to interface with Predator UAV, Outrider UAV, and U2 SAR and Electro-Optical/InfraRed (EO/IR) via ETRAC.

NOTE: A more detailed description of JSTARS AI CGS is provided in Section 5.1 of this IDD.

1.3 Document Overview.

The purpose of this IDD is to provide the interface description between the TCS and the JSTARS

AI CGS. This document was developed using MIL-STD-498 (Data Item Description DI-IPSC-84136) as a guide, and is divided into the following sections:

Section 1	Scope: Identifies the systems, interfacing entities, and interfaces addressed in this IDD; with a brief overview of each.
Section 2	Referenced Documents: Lists all referenced documents applicable to this development effort.
Section 3	Interface Design: Identifies and describes the characteristics of the interface(s) defined in this IDD.
Section 4	Requirements Traceability and Qualification Provisions: Defines the requirements traceability to the TCS SSDD, and also defines the qualification methods which are used to ensure that each requirement of this interface has been met.
Section 5	Notes: Provides background information regarding the specific C^4I system addressed; and a list of acronyms and abbreviations used in this IDD.
Appendices	As applicable to provide referenced data.

2. Referenced Documents.

2.1 Government Documents.

The following documents of the exact issue shown form part of this IDD to the extent specified herein. In the event of conflict between the documents referenced herein and the content of this IDD, the content of this IDD will be considered a superseding requirement.

2.1.1 Specifications.

Military

TCS 102 30 June 1997	Tactical Control System, System/Subsystem Specification, Version 1.0
TCS 104 Date - TBD	Tactical Control System, System/Subsystem Design Description, Version 1.0
TCS 103 29 Oct 1997	Tactical Control System, Software Requirements Specification, Version 1.1
TCS XXX April 1997	Tactical Control System, Data Server Interface Design Description, Version 1.0 (Draft)
DISA XXX.XX 31 Oct 1996	DII/COE Baseline Specifications, Version 3.0 (Series)
DISA XXX.XX Jan 1997 N250-92-L029-009 22 Aug 1997	DII/COE Integration and Runtime Specification (I&RTS), Version 3.0 Interface Design Document for the Communications Server Computer Software Component (CSC) of the COE Communications Software (CS), Revision D2

2.1.2 Standards.

Federal

Military

MIL-STD-498 5 Dec. 1994	Software Development and Documentation Standard
MIL-STD-2500A 12 October 1994	National Imagery Transmission Format Standard (Ver 2.0)
CIO-2047	Support Data Extensions (SDE) for the NITF Version 2.0 of the National Imagery Transmission Format Standard

DOD JTA 22 Aug 1996	DoD Joint Technical Architecture, Version 1.0
RMAG-9709-001 25 Sept 1997	Visible, Infrared, and Multispectral Airborne Sensor SDEs for the NITF (Version 2.0) of the NITF Standards, Version 0.9

Other Government Agency

2.1.3 Drawings.

None

2.1.4 Other Publications.

Reports

NSWCDD/96-XX 9 Dec 1996	Operational Concept Document for the TCS (Draft)
JROCM 011-97 3 Feb 1997	Tactical Control System, Operational Requirements Document, Version 5.0
TCS 233 July 1997	Tactical Control System Joint Interoperability Interface 2, Version 1.0, TCS to Service C^4I systems

Regulations

Handbooks

CIGSS-HDBK 19 July 1995	CIGSS Acquisition Standards Handbook, Version 1.0
MIL-HDBK-1300A 12 Oct 1994	National Imagery Transmission Format

Bulletins

2.2 Non-Government Documents.

The following documents of the exact issue shown form part of this IDD to the extent specified herein. In the event of conflict between the documents referenced herein and the content of this IDD, the content of this IDD will be considered a superseding requirement.

2.2.1 Specifications.

None

2.2.2 Standards.

ISO/IEC 8802-3: 1996 [ANSI/IEEE Standard 802.3 1996 Edition	Information technology--Local and metropolitan area networks--Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications [Ethernet Local Area Network(LAN) 10BASE-T and 100 BASE-TX Specification]
EIA RS-170 November 1996	Electrical Performance - Monochrome Television
EIA RS-170A (SMPTE 170M) 1994	Television Composite Analog Video Signal - NTSC

2.2.3 Drawings.

None

2.2.4 Other Publications.

None

3. Interface Design.

The TCS-to-JSTARS AI CGS interface is designed around a physical interface composed of a data link and a video physical link. The link and control for data will be based on the TCS Data Server. The TCS-to-AI CGS interface shall use either a Fiber Distributed Data Interface (FDDI) [C4I209001] or an IEEE 802.3 Ethernet Interface [C4I209002]. The TCS-to-AI CGS analog video interface shall support RS-170/RS-170A National Transmission Standards Committee (NTSC) [C4I209003] via an RG-59/U cable interface terminated with BNC connectors [C4I209004]. The protocol utilized for either the FDDI or IEEE 802.3 interface shall be Transmission Control Protocol/Internet Protocol (TCP/IP) [C4I209005].

3.1 Interface Identification/Diagram.

The TCS can be mounted in a High Mobility Multi-purpose Wheeled Vehicle (HMMWV) or configured for a Tactical Operations Center (TOC) that is collocated with the AI CGS (which is a HMMWV-mounted system). The interfaces will be based on TCP/IP, NTSC, IEEE 802.3, FDDI, and the TCS Data Server. These interfaces, their relationships, and their unique identifiers are shown in Figure 3.1-1.

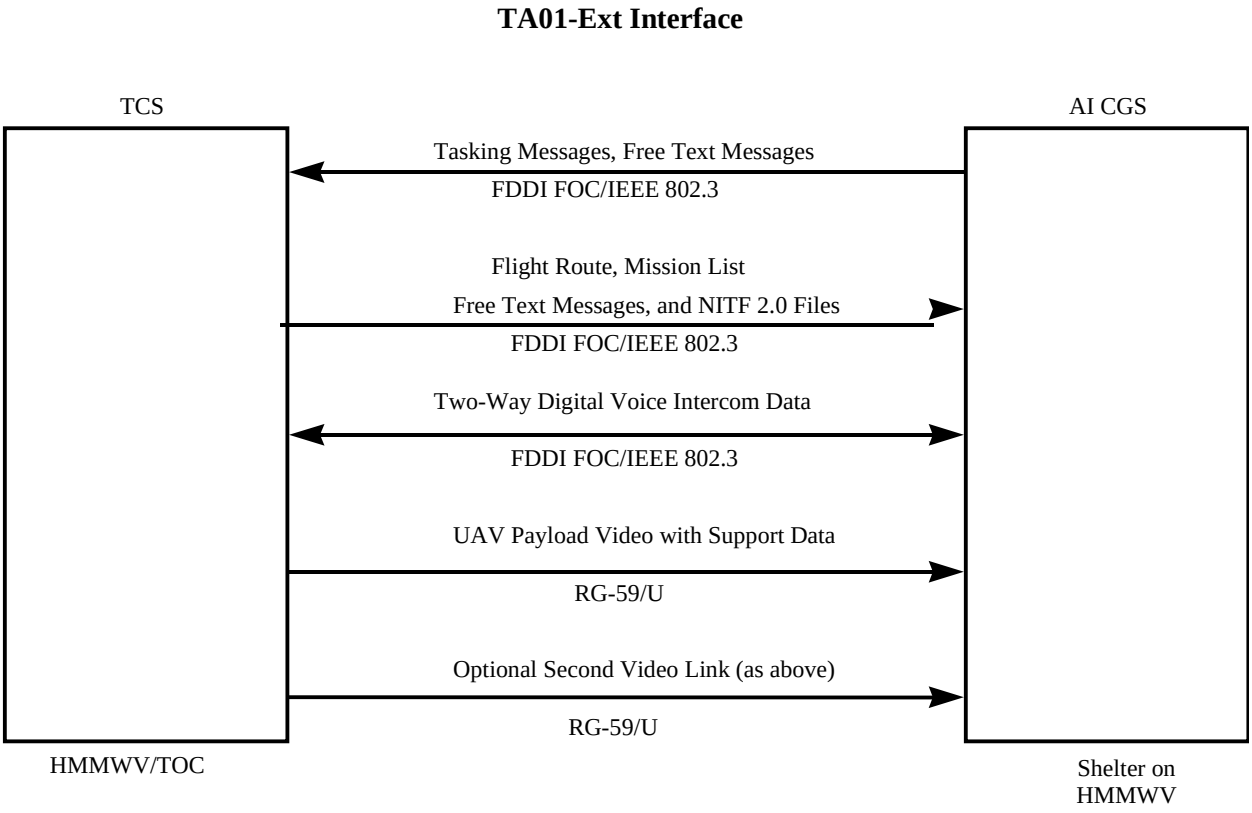

FIGURE 3.1-1 TCS-TO-AI CGS INTERFACE FOR COLLOCATED SHELTERS

3.2 TCS-to-AI CGS Interface.

There is one TCS-to-AI CGS interface designated TA01. The identification scheme is to utilize

the first letter of each system and a one up number. This provides for additional interfaces as the systems mature. Extensions to the TA01 designator are used to identify specific differing portions of the interface. For example, TA01-Ext for the external interface between the TCS HMMWV/TOC and the AI CGS HMMWV.

NOTE: A second configuration, designated TA01-Int, may be implemented in the future utilizing a different physical configuration of the TCS and AI CGS systems.

3.2.1 Priority of Interface.

(Not Applicable)

3.2.2 Type of Interface.

The TCS-to-JSTARS AI CGS interface will be a near real-time data interface. Analog video with telemetry embedded in closed captioning will be sent from TCS over an NTSC interface utilizing RG/59U coaxial cable. Flight Route and Mission List data will be sent from TCS via the TCS Data Server over an FDDI or IEEE 802.3 Ethernet connection. NITF 2.0 still imagery data will also be sent from TCS via the FDDI or IEEE 802.3 Ethernet connection (as well as tasking-related messages in the future). Freetext messages (and other tactical communications messages to be implemented) will be sent from TCS via the DII/COE Communications Server Software as specified in IDD/N250-92-L029-009.

3.2.3 Individual Data Element Characteristics.

The data elements in the message formats described below will be exchanged between the TCS and the AI CGS.

3.2.3.1 Mission List and Flight Route Data.

The sequence of messages exchanged and their contents are detailed in section 3.2.4 Data Element Assembly Characteristics. Mission List data describing the missions available to TCS for monitoring or control shall be sent to AI CGS via the TCS Data Server [C4I209006], and will utilize either an FDDI connection or an IEEE 802.3 Ethernet interface. Table 3.2.3.1-1 specifies the data elements contained in the Mission List object. Flight Route data describing the UAV flight path for a particular mission shall be sent to AI CGS via the TCS Data Server [C4I209007], and will also utilize either an FDDI connection or an IEEE 802.3 Ethernet interface. Table 3.2.3.1-2 specifies the data elements contained in the Flight Route object.

TABLE 3.2.3.1-1: MISSION LIST OBJECT DATA ELEMENTS				
NAME/DESCRIPTION	**DATA TYPE**	**DATA UNITS**	**RANGE OF VALUES**	**REMARKS**
Current_Mission This item provides an index to the currently active mission	Integer	N/A	-1 to +7	(Default value is -1) This data element is not currently utilized in the TCS Data Server.
State_Of_Entry This is a control variable for entry. It has two values to indicate whether the information in the other fields of the message are valid or not.	Integer	N/A	1 or 2	(Default value is 1) The status of State_Of_Entry can be: 1: Not Valid (Data in other fields is undefined.) 2: Valid (Data in other fields has meaning.)
Mission_Id This data element is the ASCII representation of an integer which is utilized as a mission identifier as well as the name of the group in the Data Server where the status and control objects reside for the indicated mission.	String	N/A	Maximum size of sting is 20 alphanumeric characters.	Can contain up to 19 alphanumeric characters and a null byte.
AV_Tail_Number This data item is the ASCII representation of an integer which is utilized to indicate the tail number of the mission AV.	String	N/A	Maximum size of string is 13 alphanumeric characters.	Can contain up to 12 alphanumeric characters and a null byte.
AV_Type This data element is utilized to indicate the type of AV being utilized for this particular mission.	Integer	N/A	1 through 4	(Default is 1) The status of AV_Type can be: 1: Predator 2: Outrider 3: SEAMOS 4: Hunter (Currently utilize only 1 and 2.)
State This variable is utilized to indicate the current state of the system.	Integer	N/A	1 through 4	(Default is 1) The definition of the values for this variable are currently TBD.

TABLE 3.2.3.1-1: MISSION LIST OBJECT DATA ELEMENTS				
NAME/DESCRIPTION	**DATA TYPE**	**DATA UNITS**	**RANGE OF VALUES**	**REMARKS**
Track_Id This parameter is the ASCII representation of an integer which is utilized to indicate the track database identification for this mission.	String	N/A	Maximum size of string is 20 alphanumeric characters.	Can contain up to 19 alphanumeric characters and a null byte.
AVO_Host This data element is the ASCII representation of an integer which is utilized to indicate the name of the machine where the AVO is located.	String	N/A	Maximum size of string is 28 alphanumeric characters. (HOST_NAME_SIZE)	Can contain up to 27 alphanumeric characters and a null byte.
MPO_Host This data element is the ASCII representation of an integer which is utilized to indicate the name of the machine where the MPO is located.	String	N/A	Maximum size of string is 28 alphanumeric characters. (HOST_NAME_SIZE)	Can contain up to 27 alphanumeric characters and a null byte.
Mission_Name This data element is the ASCII representation of an integer which is utilized to indicate the name of the mission currently being addressed.	String	N/A	Maximum size of string is 40 alphanumeric characters.	Can contain up to 39 alphanumeric characters and a null byte.

NOTES:
1. Currently there are 8 missions possible in this Mission Object.
2. This object is updated when a mission is added or deleted from the system, or when a State or Track_Id value changes.

TABLE 3.2.3.1-2: FLIGHT ROUTE OBJECT DATA ELEMENTS				
NAME/DESCRIPTION	**DATA TYPE**	**DATA UNITS**	**RANGE OF VALUES**	**REMARKS**
Number_Of_Points This parameter is utilized to indicate the number of waypoints contained within a particular flight route.	Integer	N/A	1 to 500 (POINT_MAX)	(Default is 1)
Waypoint_PositionX This parameter contains two 8-byte quantities which indicate the position of the waypoint in the flight route. The first represents the Latitude of Waypoint "X", and the second represents the Longitude of Waypoint "X".	LatLon	Degrees	Latitude: plus/minus 90 Longitude: plus/minus 180	The format for Wp_PositionX is: "xxxxxxxxyyyyyyyy" where x represents Latitude values and y represents Longitude values. This is equivalent to two data type "Double" in Programming Language C

Note: The following information is presented to assist in utilization of the TCS Data Server Mission List Object and the Flight Route Object:

1. The Mission List Object appears in a group called "System". The object name is MISSION_LIST. The binary schema for this object is also called MISSION_LIST.

2 The Mission List Object provides information regarding the vehicle that TCS is either controlling or monitoring. It contains information such as AV Tail Number, Mission ID of the AV, etc.

3. In the Mission List is a field called Mission_Id. This field is the name of the Group where the Air Vehicle specific information can be found (telemetry data and flight route data for that AV). The Flight Route object's name is FLIGHT_ROUTE_"MISSION.ID", where "MISSION.ID" is the value of the Mission_Id field from the MISSION_LIST Object.

4. The other field of interest from the MISSION_LIST Object is a field called State_Of_Entry. This field contains 2 values (specified in the text schema). One of these values is "VALID", the other is "NOT VALID". If this field is set as "VALID", it implies that the other fields in the Mission List are valid. If this field is set as "NOT VALID", it implies that the other fields in the Mission List are not valid.

3.2.3.2 Freetext Data Elements.

TCS will utilize the Communication Server Computer Software Component (CSC) of the DII/COE Communications Software (CS) to exchange messages with JSTARS AI CGS in accordance with the DoD Joint Technical Architecture (JTA). TCS shall exchange with AI CGS the legacy Freetext message via sendmail through the DII COE CS [C4I209008]. (NOTE: The Freetext message will be sent from TCS until JSTARS AI CGS is upgraded to process the Gentext message, which supersedes the Freetext message, in accordance with MIL-STD-6040.)

3.2.3.3 NITF Data Elements.

The TCS shall be capable of exchanging NITF 2.0 imagery files with AI CGS via a Network File Sharing (NFS) directory resident in TCS [C4I209009] and shared by TCS and AI CGS. TCS will place digital still images in the shared directory which can then be retrieved by AI CGS. NFS connectivity will be via the LAN connecting the systems. The TCS NITF 2.0 files shall contain support data embedded within the NITF data file [C4I209010]. This support telemetry data will be stored in the text field of the NITF 2.0 file. These support data parameters include:

AV Tail Nbr	AV Indicated Airspeed	EOIR Fixed Pt Long
Mission ID Nbr	GPS Time Wk	EO2 Zoom Setting
AV Position Source	GPS Time Sec	IR FoV
AV Lat Deg	AV Active Sensor	AV Roll Angle
AV Lon Deg	EOIR Pointing Mode	AV Pitch Angle
AV Alt Ft Msl	EOIR Pointing Azimuth	AV Yaw Rate
AV True Heading	EOIR Pointing Depression	AV Vertical Speed
AV Ground Track Deg	EOIR Fixed Pt Lat	AV Normal Accel
AV Next Waypoint		

(NOTE: Utilizing the MATRIX tool, the NITF file can be opened, viewed, and the support data utilized to support activities such as targeting).

Future implementation of SDEs for TCS will be in accordance with the latest approved standards for EO/IR/SAR SDEs as specified in the "Visible, Infrared, and Multispectral Airborne Sensor Support Data Extensions for the National Imagery Transmission Format", and the "Airborne Synthetic Aperture Radar SDE for NITF" as defined in the latest version of CIO-2047, "Support Data Extensions for the NITF Version 2.0 of the National Imagery Transmission Format Standard".

3.2.3.4 Analog Video/Telemetry Elements.

Analog video imagery shall be transmitted from the TCS to the AI CGS over the RG-59/U interface with parseable Exploitation Support Data (ESD) [C4I209011]. Table 3.2.3.4-1 lists the parseable ESD data items to be transmitted. TCS shall provide specific ESD data items in the closed caption "viewable" format [C4I209012]. These "viewable" parameters are shown "unshaded" in Table 3.2.3.4-1, and include:

AV Altitude	Sensor Dep Angle	Image Center Lon
AV Latitude	Sensor FoV Angle	Slant Range

AV Longitude	Payload Azimuth	Gnd Dist at Image Base
Sensor ID	Image Center Lat	Time/Date *

* These values will be alternately displayed (time, then date, then time, etc.)

TABLE 3.2.3.4-1: EXPLOITATION SUPPORT DATA (DATA ELEMENTS)					
DATA ITEM	**DG**	**UNITS**	**RANGE**	**FORMAT**	**EXAMPLES**
Target Latitude[1]	Ta	Deg/Min/Sec/ Tenths	+/- 0-90.0	PDDMMSST **P**: Sign (+ or -) **D**: Degrees digit **M**: Minutes digit **S**: Seconds digit **T**: Tenths	+89°59'59.9" => Ta+8959597 -34°26'37.5" => Ta-3426376
Target Longitude[2]	To	Deg/Min/Sec/ Tenths	+/- 0-180.0	PDDDMMSST **P**: Sign (+ or -) **D**: Degrees digit **M**: Minutes digit **S**: Seconds digit **T**: Tenths	+179°59'59.9" => To+17959597 -117° => To-11700000 -5°5'17.0" => To-00505170
Target Width[3]	Tw	Feet	0-99,999	N **N**: From 1 to 5 digits	8,123 ft => Tw8123 523 ft => Tw523
Slant Range	Sr	Feet	0-99,999	N **N**: From 1 to 5 digits	99,999 ft => Sr99999 523 ft =>Sr523
Sensor Pointing Azimuth[4]	Sp	Degrees	0-359.00	DDD.HH **D**: Degree digit **H**: Hundredths digit	359.58- => Sp359.58 23.00- => Sp23.00
Sensor Depression Angle[5]	Se	Degrees	+/- 0-180.00	PDDD.HH **P**: Sign (+ or -) **D**: Degrees digit **H**: Hundredths digit	+179.33- => Se+179.33 -5.10- => Se-5.10
Field of View[6]	Fv	Degrees	0-180.00	DDD.HH **D**: Degrees digit **H**: Hundredths digit	179.33- => Fv179.33 0.41- => Fv0.41
Sensor Altitude	Sl	Feet	+/- 0-99,999	PN **P**: Sign (+ or -) **N**: From 1 to5 digits	+24,999 ft MSL => Sl+24999 -1,023 ft MSL => Sl-1023

TABLE 3.2.3.4-1: EXPLOITATION SUPPORT DATA (DATA ELEMENTS)					
DATA ITEM	**DG**	**UNITS**	**RANGE**	**FORMAT**	**EXAMPLES**
Sensor Latitude[1]	Sa	Deg/Min/Sec/ Tenths	+/- 0.90.0	PDDMMSST **P**: Sign (+ or -) **D**: Degrees digit **M**: Minutes digit **S**: Seconds digit **T**: Tenths	+85-5959.7” => Sa+8959597 -5-0’0” => Sa-0500000
Sensor Longitude[2]	So	Deg/Min/Sec/ Tenths	+/- 0-180.0	PDDDMMSST **P**: Sign (+ or -) **D**: Degrees digit **M**: Minutes digit **S**: Seconds digit **T**: Tenths	+179-59’59.7” => So+17959597 -5-0’0” => So-00500000
Sensor Name	Sn	Name Code	0-5	**0**: EO Nose **1**: EO Zoom **2**: EO Spotter **3**: IR Mitsubishi PtSi Model 500 **4**: IR Mitsubishi PtSi Model 600 **5**: IR InSb Amber Model TBD	EO Spotter => Sn2
Image Coordinate System	Ic	Coordinate Code	0-2	**0**: Geodetic WGS 84 **1**: Geocentric WGS 84 **2**: None	Geocentric => Ic1
Date of Collection	Cd	Date		CCYYMMDD CC = Century YY = Year MM = Month DD = Day	May 23, 1997 => Cd19970523
Time of Collection	Ct	Time	0-235959	HHMMSS HH = Hour MM = Month SS = Seconds	5:23:06 PM => Ct172306 3:06:27 AM => Ct030627
Mission Number	Mn	Number	1-9999999	N **N**: From 1 to 7 digits	3324 => Mn3324

TABLE 3.2.3.4-1: EXPLOITATION SUPPORT DATA (DATA ELEMENTS)					
DATA ITEM	**DG**	**UNITS**	**RANGE**	**FORMAT**	**EXAMPLES**
Mission Start Date	Md	Date		CCYYMMDD CC = Century YY = Year MM = Month DD = Day	April 23, 1997 => Md19970423
Mission Start Time	Mt	Time	0-235959	HHMMSS HH = Hour MM = Minute SS = Seconds	9:24:56 PM => Mt212456 5:08:02 AM => Mt050802
Classification	Cl	Classification Code	U/R/C/S/T	**U**: Unclassified **R**: Restricted **C**: Confidential **S**: Secret **T**: TopSecret	Confidential => Cl<esc>C Secret => Cl<esc>S
Project ID Code[7]	Pc	Number	0-99	N **N**: From 1 to 2 digits	25 => Pc25
ESD ICD Version	Iv	Count	0-999	N **N**: From 1 to 3 digits	Version 5 => Iv5

Notes:

1) A plus sign (+) indicates North Latitude. All Latitude coordinates use WGS84.
2) A minus sign (-) indicates East Longitude. All Longitude coordinates use WGS84.
3) At center of image.
4) Relative to true North.
5) Relative to Planetary Tangent at Nadir. 0 is Horizon, -90 is Straight down (nadir).
6) Horizontal, across center of image.
7) The Project ID of the Collection Platform.
8) "Unshaded" Data Items are those which will be in the "viewable" closed caption format.

3.2.3.5 Voice.

A voice communications hardware and software intercom system shall be utilized between the TCS and the AI CGS for operator to operator coordination [C4I209013]. The voice software shall operate over the FDDI or IEEE 802.3 interface utilizing TCP/IP [C4I209014]. (NOTE: JSTARS AI CGS currently uses "ShowMe TV", a Commercial Off the Shelf (COTS) product, to support its voice interface with other systems.)

3.2.3.6 Tactical Enhanced Synthetic Aperture Radar (TESAR) Waterfall.

The TESAR Waterfall data shall be sent from TCS to the AI CGS in the TESAR format [C4I209015]. (Future - implementation details are TBD).

3.2.3.7 Image Product Library (IPL).

When TCS is connected to an IPL, the TCS shall post imagery files to the IPL and notify the AI CGS that new imagery products have been placed in the IPL [C4I209016]. The AI CGS can then access these files via standard IPL Government Off the Shelf (GOTS) library interfaces as desired. (Future - implementation details are TBD).

3.2.3.8 AI CGS-to-TCS Tasking.

The JSTARS AI CGS has a requirement to be able to task the TCS in order to have the UAV fly to specific areas of interest to the AI CGS, look at specified targets in that area, etc. The TCS shall accept and respond to Tasking Requests from the AI CGS [C4I209017].

This tasking requirement is for future implementation, and the detailed implementation requirements are TBD. Generally, however, this capability would allow the AI CGS to specify a particular area of interest, type of sensor data desired, time to collect data, etc. via an imagery service request. The TCS would acknowledge receipt of that tasking request, and then consider the alternatives. After evaluating the request, the TCS would notify the AI CGS of the plan of action for that request and send flight plan data to the AI CGS. At the appropriate time, theTCS would conduct the requested action(s), sending flight plan updates, video images, and telemetry data to the AI CGS for utilization.

3.2.4 Data Element Assembly Characteristics.

The Data Element Assemblies/Messages exchanged over the TCS-to-AI CGS interface are listed in this section. The individual data elements of these messages were previously defined in greater detail in Section 3.2.3 as applicable.

3.2.4.1 TCS-to-AI CGS.

The TCS will send the following Data Element Assemblies/Messages to the AI CGS:

a. Mission List Data
b. Flight Route Data
c. Freetext Message (MIL-STD-6040 format)
d. NITF 2.0 Imagery Files with Support Data
e. Analog Video with Closed Caption Support Data

f. Voice Communications
h. TESAR Waterfall Data (future definition and implementation)
i. Tasking-related Messages (future definition and implementation)

3.2.4.2 AI CGS-to-TCS.

The TCS will receive the following Data Element Assemblies/Messages from the AI CGS:

a. Freetext Message (MIL-STD-6040 format)
b. Tasking-related Messages (future definition and implementation)

3.2.5 Communication Methods Characteristics.

There are two unique communications methods for the TA01 interface. Each has a unique identifier consisting of the TA01 designator and a series of hyphened suffixes to complete the identification.

3.2.5.1 TA01-Ext Interface.

TA01-Ext designates communications via either FDDI cable or IEEE 802.3 Ethernet LAN between shelters/configurations when the TCS and the AI CGS are collocated in separate adjacent shelters to pass Freetext messages, NITF imagery files, TCS Data Server data (Mission List and Flight Route), voice data, TESAR waterfall data files (future), and tasking-related messages (future).

The FDDI interface will utilize a dedicated FDDI, Dual Attached Station (DAS) 62.5/125 micrometer, multimode, fiber optic cable using TCP/IP. The data transfer rate for this FDDI LAN will be 100 megabits per second (Mbps). Routing, addressing, and naming conventions will be determined at installation by the FDDI LAN manager. The router will be a Cisco 4700 with an NP-1F-D-MM plug-in. The FDDI connection will be in accordance with the ANSI X3T9.5 standard which specifies all frequency, media, and characteristic requirements for this TA01-Ext communication link. The specific connector types used to implement the FDDI is TBD. The establishment of the FDDI network will be in accordance with the ANSI FDDI standard which allows for 500 Dual-attached nodes, 2km (maximum) between nodes, with a maximum overall length of 100 km. The data exchanged on the TA01-Ext link will be SECRET NOFORN at the highest security classification. The link will be a system high datalink. The physical proximity of the TCS and the AI CGS, and the use of an FDDI optical LAN connection, does not require the use of encryption on the TA01-Ext link.

3.2.5.2 TA01-RS-170 Interface.

The TA01-RS-170 interface designates communications via the RS-170 (monochrome)/RS-170A (color) NTSC analog video signal cable passing video and the associated closed caption support data. The closed captioning methodology will be utilized to transmit the associated support data within the particular analog video stream. The bandwidth required to transmit the RS-170/RS-170A NTSC analog video signal will be approximately 4.5 Mhz.

This NTSC analog video interface will be a dedicated point to point interface that does not use any routing. Once received by the AI CGS, all routing of the video signal will be done via the

AI CGS video switching matrix. Control of this matrix may be either automated or manual, and is the responsibility of the AI CGS, and does not affect the TA01 interface. The transmission media will be a dedicated RG-59/U coax cable (75 ohm characteristic impedance). The AI CGS can support up to two RS-170/RS-170A connections.

The video and the associated support data will be SECRET NOFORN at the highest security classification.

3.2.6 Protocol Characteristics.

There are two different protocols used to communicate messages and video data passed between the TCS and the AI CGS. When the TCS and the AI CGS are collocated, the FDDI protocol will be utilized with TCP/IP and the TCS Data Server as a means to communicate. A coaxial cable interface will be utilized to transmit the NTSC analog video and the associated closed captioned support data.

3.2.7 Other Characteristics.

Not Applicable.

4. Requirements Traceability and Qualification Provisions.

This section defines the traceability of each C^{4}I requirement in this IDD, as shown in Table 4.0-1 below, to the TCS SSDD requirements specified in the TCS SSDD Version 1.0. This section also defines the qualification methods to be used to ensure that each requirement of this interface has been met. These qualification methods are defined as:

D	Demonstration	The operation of the interfacing entities that relies on observable functional operation not requiring the use of instrumentation, special test equipment, or subsequent analysis.
T	Test	The operation of the interfacing entities using instrumentation or special test equipment to collect data for later analysis.
A	Analysis	The processing of accumulated data obtained from other qualification methods. Examples are reduction, interpretation, or extrapolation of test results.
I	Inspection	The visual examination of code, documentation, etc.
S	Special	Any special qualification methods such as special tools, techniques, procedures, facilities, and acceptance limits.

Table 4.0-1 lists each requirement of the TCS-to-AI CGS interface with its C^{4}I IDD requirement number, traceability to the SSDD, the IDD paragraph number where the requirement is found, and the qualification method.

TABLE 4.0-1
TCS-to-AI CGS REQUIREMENT TRACEABILITY AND QUALIFICATION METHODS

IDD Requirement Number	Requirement	Paragraph Number	SSDD Req.(s)	Qualification Method(s)
C4I209001	FDDI Interface.	3.0	TBD	D, I
C4I209002	IEEE 802.3 Ethernet Interface.	3.0	TBD	D, I
C4I209003	NTSC Analog Video Interface.	3.0	TBD	D, I
C4I209004	RG-59/U cable terminated with BNC connectors for NTSC interface.	3.0	TBD	D, I
C4I209005	TCP/IP Protocol for FDDI/IEEE 802.3.	3.0	TBD	D
C4I209006	Mission List data sent from TCS Data Server.	3.2.3.1	TBD	D
C4I209007	Flight Route data sent from TCS Data Server.	3.2.3.1	TBD	D
C4I209008	Freetext message exchanged via sendmail between TCS and AI CGS.	3.2.3.2	TBD	D
C4I209009	NITF 2.0 Imagery from TCS via NFS shared directory within TCS.	3.2.3.3	TBD	D
C4I209010	Support Data from TCS embedded within NITF data file in the Text Field.	3.2.3.3	TBD	D
C4I209011	Analog Video from TCS with parseable ESD. (Table 3.2.3.4-1)	3.2.3.4	TBD	D
C4I209012	Analog Video ESD in closed caption “viewable” format. (Table 3.2.3.4-1)	3.2.3.4	TBD	D
C4I209013	Voice comms interface (hardware and software) between TCS and AI CGS.	3.2.3.5	TBD	D
C4I209014	Voice software interface utilizing TCP/IP.	3.2.3.5	TBD	D
C4I209015	TESAR Waterfall data from TCS to AI CGS.	3.2.3.6	TBD	D
C4I209016	TCS post imagery files to IPL and notify AI CGS.	3.2.3.7	TBD	D
C4I209017	TCS accept tasking orders from AI CGS.	3.2.3.8	TBD	D

5. Notes.

5.1 Background Information.

Detailed information regarding the JSTARS AI CGS system is TBD.

5.2 Acronyms and Abbreviations.

A	Analysis
ACS	Aerial Common Sensor
AFATDS	Advanced Field Artillery Tactical Data System
AFMSS	Air Force Mission Support System
AI CGS	Advanced Imagery Common Ground Station
AMPS	Army Mission Planning System
AOI	Area of Interest
ARL	Airborne Reconnaissance Low
ASAS	All Source Analysis System
ATHS	Automated Target Handoff System
ATWCS	Advanced Tomahawk Weapons Control System
CARS	Contingency Airborne Reconnaissance System
CCTV	Closed Circuit TeleVision
CGS	Common Ground Station
CIGSS	Common Imagery Ground/Surface System
COE	Common Operating Environment
COMPASS	Common Operational Modeling, Planning, and Simulation Strategy
COSIP	Computer Open Systems Interface Processor
COTS	Commercial Off The Shelf
CS	Communications Server
CSC	Computer Software Component
CSMA/CD	Carrier Sense Multiple Access with Collision Detection
C^4I	Command, Control, Communications, Computers, and Intelligence
D	Demonstration

DAS	Dual Attached Station
DCGS	Distributed Common Ground System
Dep	Depression
DID	Data Item Description
DII	Defense Information Infrastructure
Dist	Distance
DoD	Department of Defense
DoDI	Department of Defense Instruction
EO/IR	Electro-Optical / InfraRed
ESD	Exploitation Support Data
ETRAC	Enhanced Tactical Radar Correlator
FDDI	Fiber Distributed Data Interface
FOC	Fiber Optic Cable
FoV	Field of View
FTI	Fixed Target Indicator
Gnd	Ground
GOTS	Government Off The Shelf
GSM	Ground Station Module
HAE	High Altitude Endurance
HCI	Human Computer Interface
HDBK	Handbook
HMMWV	High Mobility Multi-purpose Wheeled Vehicle

I	Inspection
IAS	Intelligence Analysis System
IBS	Intelligence Broadcast System
ID	Identification
IDD	Interface Design Description
IPB	Intelligence Preparation of the Battlefield
IPF	Integrated Processing Facility
IPL	Image Product Library
IPT	Integrated Product Team
IRS	Interface Requirements Specification
ISR	Imagery Service Request
JDISS	Joint Deployable Intelligence Support System
JMCIS	Joint Maritime Command Information System
JMF	Joint Message Format
JPO	Joint Project Office
JSIPS-AF	Joint Service Imagery Processing System - Air Force
JSIPS-N	Joint Service Imagery Processing System - Navy
JSTARS	Joint Surveillance Target Attack Radar System
JTA	Joint Technical Architecture
LAN	Local Area Network
Lat	Latitude
Lon	Longitude
LRIP	Low Rate Initial Production

MAE	Medium Altitude Endurance
Mbps	Megabits per second
Mhz	Megahertz
MIES	Modernized Imagery Exploitation System
MTI	Moving Target Indicator
NITF	National Imagery Transmission Format
NRE	Non-Recurring Engineering
NSWCDD	Naval Surface Warfare Center Dahlgren Division
NTSC	National Transmission Standards Committee
ORD	Operational Requirements Document
P3I	Pre-Planned Product Improvement
RAD	Requirements, Analysis, and Design
S	Special
SAR	Synthetic Aperture Radar
SCDL	Sensor Control Data Link
SDE	Support Data Extension
SPIRIT	Special Purpose Integrated Remote Intelligence Terminal
SRS	Software Requirements Specification
SSDD	System/Subsystem Design Description
SSS	System/Subsystem Specification

T	Test
TAMPS	Tactical Aircraft Mission Planning System
TBD	To Be Determined
TBMCS	Theater Battle Management Core System
TCP/IP	Transmission Control Protocol/Internet Protocol
TCS	Tactical Control System
TEG	Tactical Exploitation Group
TES	Tactical Exploitation System
TESAR	Tactical Enhanced Synthetic Aperture Radar
TOC	Tactical Operations Center
TUAV	Tactical Unmanned Aerial Vehicle
UAV	Unmanned Aerial Vehicle
VMF	Variable Message Format